## CLAIMS

What is claimed is:

1. A voltage generating circuit comprising:

a first capacitor,

a second capacitor which is a ferroelectric capacitor serially connected to the first capacitor,

an output terminal,

a third capacitor which grounds the output terminal,

a supply voltage supplying terminal,

a first switch which connects a connecting node of the first and second capacitors and the supply voltage supplying terminal, and

a second switch which connects the connecting node and the output terminal;

wherein during a first period, with the first switch and second switch placed in the OFF state, a first terminal of the first capacitor opposed to the connecting node is grounded and a second terminal of the second capacitor opposed to the connecting node is provided with a supply voltage;

wherein during a second period following the first period, the first terminal is provided with the supply voltage and the second switch is placed in the ON state;

wherein during a third period following the second period, the first switch is placed in the ON state, the second switch is placed in the OFF state, and the second terminal is grounded;

wherein during a fourth period following the third period, the second terminal is provided with the supply voltage; and

wherein thereafter the first through fourth periods are repeated.

2. A voltage generating circuit according to claim 1, wherein each of the first switch and second switch is composed of a p-channel MISFET; and

wherein the substrate of the p-channel MISFET constituting each of the first switch and the second switch is connected to the supply voltage supplying terminal.

3. A method for driving a voltage generating circuit comprising;

a first capacitor,

a second capacitor which is a ferroelectric capacitor serially connected to the first capacitor,

an output terminal,

a third capacitor which grounds the output

terminal,

a supply voltage supplying terminal,

a first switch which connects a connecting node of the first and second capacitors and the supply voltage supplying terminal, and

a second switch which connects the connecting node and the output terminal;

the method comprising:

a first period during which a first terminal of the first capacitor opposed to the connecting node is grounded, a second terminal of the second capacitor opposed to the connecting node is provided with a supply voltage, and the first switch and the second switch are placed in the OFF state;

a second period following the first period, during which the first terminal is provided with the supply voltage and the second switch is placed in the ON state;

a third period following the second period, during which the first switch is placed in the ON state, the second switch is placed in the OFF state, and the second terminal is grounded;

a fourth period following the third period, during which the second terminal is provided with the supply voltage;

wherein thereafter the first through fourth periods are repeated.

4. A voltage generating circuit comprising two voltage generating circuits according to claim 1,

wherein one of the voltage generating circuits has the output terminal connected to the supply voltage supplying terminal of the other voltage generating circuit.

5. A voltage generating device comprising:

a voltage generating circuit according to claim 1;

a control circuit for supplying to the voltage generating circuit driving signals for firstly placing the first switch and the second switch in the OFF state, grounding the first terminal, and providing the second terminal with the supply voltage, then secondly providing the first terminal with the supply voltage, placing the second switch in the ON state, then thirdly placing the first switch and the second switch in the ON and OFF states respectively, grounding the second terminal, and then fourthly providing the second terminal with the supply voltage; and

a voltage detection circuit for detecting an output voltage at the output terminal;

wherein the voltage detection circuit provides the control circuit with a control signal in response to the detected output voltage; and

wherein the control circuit provides or stops providing the driving signals in response to the control signal.

6. A voltage generating device according to claim 5, wherein the voltage detection circuit:

provides an enabling signal so that the control circuit can provide the driving signals when the value of the output voltage is equal to or less than a first value;

continues to provide the enabling signal until the value of the output voltage is equal to or more than a second value;

provides a stop signal so that the control circuit stops providing the driving signals when the value of the output voltage is equal to or more than the second value; and

continues to provide the stop signal until the output voltage is equal to or less than the first value.

7. A method for driving a voltage generating device comprising;

a voltage generating circuit according to claim

1,

a control circuit for supplying to the voltage generating circuit driving signals, and

a voltage detection circuit for supplying a control signal to the control circuit;

the method comprising:

a detecting step wherein the voltage detection circuit detects an output voltage at the output terminal in the voltage generating circuit;

an enabling step wherein the voltage detection circuit provides an enabling signal so that the control circuit can provide the driving signals when the value of the output voltage is equal to or less than a first value, and the voltage detection circuit continues to provide the enabling signal until the value of the output voltage is equal to or more than a second value;

a driving step wherein the control circuit provides the voltage generating circuit with the driving signals upon receipt of the enabling signal;

a disabling step wherein the voltage detection circuit provides a stop signal so that the control circuit can stop providing the driving signals when the value of the output voltage is equal to or more than the second value, and the voltage detection circuit continues to provide the stop signal until the value of the output

voltage is equal to or less than the first value; and

a stopping step wherein the control circuit stops providing the voltage generating circuit with the driving signals upon receipt of the stop signal.

8. A voltage generating device comprising:

a voltage generating circuit according to claim 1;

a control circuit for supplying to the voltage generating circuit driving signals for firstly placing the first switch and the second switch in the OFF state, grounding the first terminal, and providing the second terminal with the supply voltage, then secondly providing the first terminal with the supply voltage, placing the second switch in the ON state, then thirdly placing the first switch and the second switch in the ON and OFF states respectively, grounding the second terminal, and then fourthly providing the second terminal with the supply voltage; and

a voltage detection circuit for detecting an output voltage at the output terminal;

wherein the voltage detection circuit provides a predetermined signal when the value of the detected output voltage is equal to or less than a predetermined value;

wherein in the state that the control circuit

provides the driving signals for supplying the first terminal and second terminals with the supply voltage and supplying such voltages that the first switch is placed in the ON state and the second switch is placed in the OFF state, when the control circuit receives the predetermined signal, the control circuit provides the driving signals for grounding the first terminal, supplying the supply voltage to the second terminal, and supplying such voltages that the first switch and the second switch are placed in the OFF state.

9. A voltage generating device comprising:

a first voltage generating circuit according to claim 1;

a second voltage generating circuit configured to comprise a fourth capacitor, a fifth capacitor which is a ferroelectric capacitor connected in series to the fourth capacitor, a sixth capacitor for grounding the output terminal, a third switch for connecting a second connecting node between the fourth capacitor and the fifth capacitor to the supply voltage supplying terminal, and a fourth switch for connecting the second connecting node to the output terminal;

a first control circuit for providing the first voltage generating circuit with first driving signals for

firstly placing the first switch and the second switch in the OFF state, grounding the first terminal, and providing the second terminal with the supply voltage, and then secondly providing the first terminal with the supply voltage and placing the second switch in the ON state, and then thirdly placing the first switch and the second switch in the ON and OFF states respectively and grounding the second terminal, and then fourthly providing the second terminal with the supply voltage;

a second control circuit for providing the second voltage generating circuit with second driving signals for firstly placing the third switch and the fourth switch in the OFF state, grounding a third terminal of the fourth capacitor opposed to the second connecting node and providing a fourth terminal of the fifth capacitor opposed to the second connecting node with the supply voltage, then secondly providing the third terminal with the supply voltage and placing the fourth switch in the ON state, then thirdly placing the third switch and the fourth switch in the ON and OFF states respectively and grounding the fourth terminal, and then fourthly providing the fourth terminal with the supply voltage; and

a voltage detection circuit for detecting an output voltage at the output terminal;

wherein an output timing of the first driving

signals is shifted from an output timing of the second driving signals by a half cycle;

wherein the voltage detection circuit provides the first control circuit and the second control circuit with a control signal in response to the detected output voltage;

wherein the first control circuit provides or stops providing the first driving signals in response to the control signal; and

wherein the second control circuit provides or stops providing the second driving signals in response to the control signal.

10. A voltage generating device according to claim 9,

wherein the voltage detection circuit:

provides an enabling signal so that the first control circuit and the second control circuit can provide the first driving signals and the second driving signals respectively when the value of the output voltage is equal to or less than a first value;

continues to provide the enabling signal until the value of the output voltage is equal to or more than a second value;

provides a stop signal so that the first control circuit and the second control circuit can stop providing

the first driving signals and the second driving signals respectively when the value of the output voltage is equal to or more than the second value; and

continues to provide the stop signal until the value of the output voltage is equal to or less than the first value.

11. A method for driving a voltage generating device comprising;

a first voltage generating circuit according to claim 1,

a second voltage generating circuit configured to comprise a fourth capacitor, a fifth capacitor which is a ferroelectric capacitor connected in series to the fourth capacitor, a sixth capacitor for grounding the output terminal, a third switch for connecting a second connecting node between the fourth capacitor and the fifth capacitor to the supply voltage supplying terminal, and a fourth switch for connecting the second connecting node to the output terminal,

a first control circuit for providing the first voltage generating circuit with first driving signals for firstly placing the first switch and the second switch in the OFF state, grounding the first terminal, and providing the second terminal with the supply voltage, and then

secondly providing the first terminal with the supply voltage and placing the second switch in the ON state, and then thirdly placing the first switch and the second switch in the ON and OFF states respectively and grounding the second terminal, and then fourthly providing the second terminal with the supply voltage,

a second control circuit for providing the second voltage generating circuit with second driving signals for firstly placing the third switch and the fourth switch in the OFF state, grounding a third terminal of the fourth capacitor opposed to the second connecting node and providing a fourth terminal of the fifth capacitor opposed to the second connecting node with the supply voltage, then secondly providing the third terminal with the supply voltage and placing the fourth switch in the ON state, then thirdly placing the third switch and the fourth switch in the ON and OFF states respectively and grounding the fourth terminal, and then fourthly providing the fourth terminal with the supply voltage, and

a voltage detection circuit for detecting an output voltage at the output terminal;

the method comprising:

a detecting step wherein the voltage detection circuit detects an output voltage at the output terminal;

an enabling step wherein the voltage detection

circuit provides an enabling signal so that the first control circuit and the second control circuit can provide the first driving signals and the second driving signals respectively when the value of the detected output voltage is equal to or less than a first value, and the voltage detection circuit continues to provide the enabling signal until the value of the output voltage is equal to or more than a second value;

a disabling step wherein the voltage detecting circuit provides a stop signal so that the first control circuit and the second control circuit can stop providing the first driving signals and the second driving signals respectively when the value of the output voltage is equal to or more than the second value, and the voltage detection circuit continues to provide the stop signal until the value of the output voltage is equal to or less than the first value;

a first driving step wherein the first control circuit provides the first voltage generating circuit with the first driving signals upon receipt of the enabling signal;

a first stopping step wherein the first control circuit stops providing the first voltage generating circuit with the first driving signals upon receipt of the stop signal;

a second driving step wherein the second control circuit provides the second voltage generating circuit with the second driving signals, at a timing shifted by a half cycle from the output timing of the first driving signals, upon receipt of the enabling signal; and

a second stopping step wherein the second control circuit stops providing the second voltage generating circuit with the second driving signals upon receipt of the stop signal.

12. A semiconductor device comprising:

a voltage generating device comprising a voltage generating circuit according to claim 1,

a first pass transistor, and

a fifth transistor which connects an output terminal of the voltage generating device to a first gate of the first pass transistor;

wherein when the fifth switch is placed in the ON state, a voltage is applied to the first gate from the output terminal of the voltage generating device so that the first pass transistor is placed in the ON state to output an input signal as an output signal.

13. A semiconductor device according to claim 12 further comprising a logic circuit which supplies an input

signal to the first pass transistor, or

a wiring which transmits an output signal from the first pass transistor.

14. A semiconductor device according to claim 12 comprising:

a second pass transistor, and

an inverter connected between the first gate of the first pass transistor and a second gate of the second pass transistor;

wherein an output terminal of the first pass transistor and an output terminal of the second pass transistor are connected;

the inverter reverses a voltage applied to the first gate and applies the reversed voltage to the second gate; and

either an input signal to the first pass transistor or an input signal to the second pass transistor is outputted as an output signal, depending on whether the fifth switch is placed in the ON or OFF state.

15. A semiconductor device comprising:

a memory cell,

a sixth switch, and

a voltage generating device comprising a voltage

generating circuit according to claim 1 which is connected to a word line of the memory cell via the sixth switch;

wherein the sixth switch is placed in the ON state during the read period of the memory cell.

16. A semiconductor device according to claim 15, wherein the memory cell comprises a third pass transistor and a seventh capacitor.

17. A semiconductor device comprising:

a voltage generating device comprising a voltage generating circuit according to claim 1,

a logic circuit comprising an MIS transistor,

a high-threshold n-channel MISFET connecting the logic circuit to a predetermined voltage and having a threshold voltage larger than that of the MIS transistor, and

a seventh switch for connecting a gate of the high-threshold n-channel MISFET to the voltage generating device;

wherein the seventh switch is placed in the ON state while the logic circuit is in operation and in the OFF state while the logic circuit is on standby.

18. A semiconductor device comprising:

a voltage generating device comprising a voltage generating circuit according to claim 1,

a logic circuit comprising an MIS transistor,

a high-threshold p-channel MISFET connecting the logic circuit to a predetermined voltage and having a threshold voltage larger than that of the MIS transistor, and

an eighth switch for connecting a gate of the high-threshold p-channel MISFET to the voltage generating device;

wherein the eighth switch is placed in the ON state while the logic circuit is on standby and in the OFF state while the logic circuit is in operation.

19. A method for driving a semiconductor device comprising;

a voltage generating device which comprises a voltage generating circuit according to claim 1,

a logic circuit comprising an MIS transistor,

a high-threshold n-channel MISFET connecting the logic circuit to a predetermined voltage and having a threshold voltage larger than that of the MIS transistor, and

a seventh switch for connecting a gate of the high-threshold n-channel MISFET to the voltage generating

device;

the method comprising:

an operating step wherein while the logic circuit is in operation, the seventh switch is placed in the ON state and a high voltage is supplied by the voltage generating device to the gate of the high-threshold n-channel MISFET; and

a standby step wherein while the logic circuit is on standby, the seventh switch is placed in the OFF state and a voltage lower than the threshold voltage of the high-threshold n-channel MISFET is supplied to the gate of the high-threshold n-channel MISFET.

20. A method for driving a semiconductor device comprising:

a voltage generating device which comprises a voltage generating circuit according to claim 1,

a logic circuit comprising an MIS transistor,

a high-threshold p-channel MISFET connecting the logic circuit to a predetermined voltage and having a threshold voltage larger than that of the MIS transistor, and

an eighth switch for connecting a gate of the high-threshold p-channel MISFET to the voltage generating device;

the method comprising:

a standby step wherein while the logic circuit is on standby, the eighth switch is placed in the ON state and a high voltage is supplied by the voltage generating device to the gate of the high-threshold p-channel MISFET; and

an operating step wherein while the logic circuit is in operation, the eighth switch is placed in the OFF state and a voltage lower than the threshold voltage of the high-threshold p-channel MISFET is supplied to the gate of the high-threshold p-channel MISFET.